

Amendments to the Specification

Please amend the specification as follows:

- Please replace the paragraph that begins at page 11, line 3, with the following amended paragraph:

The programmable non-volatile memory 214, which may be embodied as a flash programmable EEPROM, stores configuration information for the sensor module 204. By way of example, programmable non-volatile memory 214 preferably includes system identification information, which is used to associate the information generated by the sensor module 204 with its physical and/or logical location in the building control system. For example, the programmable non-volatile memory 214 may contain an "address" or "ID" of the sensor module 204 that is appended to any communications generated by the sensor module ~~440~~ 204.

- Please replace the paragraph that begins at page 14, line 9, with the following amended paragraph:

The actuator module 208 is also preferably embodied as a wireless integrated network device that incorporates microelectromechanical system ("MEMS") devices. By way of example, in the exemplary embodiment described herein, the actuator module 208 includes a MEMS local RF communication circuit 250, a microcontroller 252, a programmable non-volatile memory 254, and a signal processing circuit 256. The actuator module 208 also contains a power supply/source 260. In the preferred embodiment described herein, the power supply/source 260 is a battery, for example, a coin cell battery. However, it will be appreciated that if AC power is necessary for the actuator device (i.e. the damper actuator), which may be solenoid or ~~valve~~ valve, then AC power is readily available for the power supply/source 260. As a consequence, the use of battery power is not necessarily advantageous.

- Please replace the paragraph that begins at page 17, line 10, with the following amended paragraph:

Referring again to Fig. 2, to allow for wireless communication between controller subsystems of the building control system 100, the network interface 270 is preferably an RF modem configured to communicate using the wireless area network communication scheme. Preferably, the network interface 270 employs a packet-hopping protocol to reduce the overall transmission power required. In packet-hopping, each message may be transmitted through multiple intermediate network interfaces before it reaches its destination. Referring again to Fig. 1, if the space control subsystem 110 sends a message to the fan control subsystem ~~406~~ 108, the network interface of the space control subsystem 110 provides the message to the physically closest subsystem. Thus, in the embodiment shown in Fig. 1, the network interface of the space control subsystem 110 provides the message to the network interface of the space control subsystem 112. The network interface of the space control subsystem 112 reads the destination address of the message and determines that the message is not intended to be received at the space control subsystem 112. As a consequence, the network interface of the space control subsystem 112 passes the message along to the network interface of the next closest subsystem, which is the space control subsystem 114. The network interface of the space control subsystem 114 similarly passes the message onto the fan control subsystem ~~446~~ 108. The network interface of the fan control subsystem ~~446~~ 108, however, recognizes from the destination address in the message that it is the intended recipient. The network interface of the fan control subsystem ~~446~~ 108 thus receives the message and processes it.

- Please replace the paragraph that begins at page 19, line 19, with the following amended paragraph:

The programmable non-volatile memory 274, which may be embodied as a flash programmable EEPROM, stores configuration information for the hub module ~~274~~ 202. By way of example, programmable non-volatile memory 274 preferably includes system identification information, which is used to associate the information generated by the ~~sensor~~ hub module ~~274~~ 202 with its physical and/or logical location in the building control system.

The memory 274 further includes set-up configuration information related to the type of sensor being used. The memory 274 may further include calibration information regarding the sensor, and system RF communication parameters employed by the control processor 272, the network interface 270 and/or the local RF communication circuit 280.

- Please replace the paragraph that begins at page 20, line 19, with the following amended paragraph:

The control processor 272 is a processing circuit operable to control the general operation of the hub module ~~274~~ 202. In addition, the control processor 272 implements a control transfer function to generate control output values that are provided to the actuator module 208 in the space control subsystem 110. To this end, the control processor 272 obtains sensor information from its own sensor suite 278 and/or from sensor modules 204 and 206. The control processor 272 also receives a set point value, for example, from the supervisory computer 102 via the network interface 270. The control processor 272 then generates the control output value based on the set point value and one or more sensor values. The control processor 272 may suitably implement a proportional-integral-differential (PID) control algorithm to generate the control output values. Suitable control algorithms that generate control output values based on sensor or process values and set point values are known.

- Please replace the paragraph that begins at page 26, line 13, with the following amended paragraph:

With regard to the sensor values, Fig. 4 shows an exemplary set of operations performed by the sensor module 204 in generating and transmitting temperature sensor values to the hub module 202 in accordance with step ~~302~~ 304 of Fig. 3. The sensor module 206 may suitably perform a similar set of operations to generate and transmit flow sensor values to the hub module 202 in accordance with step ~~304~~ 302 of Fig. 3.

- Please replace the paragraph that begins at page 30, line 21, with the following amended paragraph:

The control module ~~620~~ 630 generally operates to effectuate communication between the space control subsystem 114 and the other subsystems of the building control system 100 (see Fig. 1). In the embodiment described herein, the control module ~~620~~ 630 further includes a temperature sensor. The supply flow module 632 controls the supply damper 620 to regulate the supply of air flow into the space 610, and further controls the supply of heat (or cool) water to the heating coil element 616 disposed in the path of the air flow supply. The main exhaust module 634 controls the main exhaust damper 624 to regulate the flow of air out of the space 610, such that in general the atmospheric pressure within the room is controlled by the cooperative efforts of the supply flow module 622 and the main exhaust module 624.

- Please replace the paragraph that begins at page 33, line 16, with the following amended paragraph:

The power management circuit 1258 that preferably operates to recharge the lithium ion battery layer 1204 of ~~Fig. 6~~ Fig. 12A, and may include semiconductor devices that convert light or RF energy into electrical energy that may be used to trickle charge the lithium ion battery.

- Please replace the paragraph that begins at page 35, line 4, with the following amended paragraph:

However, in one embodiment of the invention, most or all of the code unique to the selected function of the module is downloaded into the EEPROM 1254 during configuration of the device. Thus, if the module 1200 is to operate as a temperature sensor module, then all appropriate code for a temperature sensor module is downloaded to the EEPROM 1254, as is identification information and calibration information. This method ~~provide~~ provides maximum flexibility because a single module 1200 may be programmed to do many custom tailored tasks, in addition to performing sensor functions.

- Please replace the paragraph that begins at page 38, line 22, with the following amended paragraph:

Referring to Fig. 6, the set points W_{G1FL} and W_{G2FL} represent the exhaust air flow through the exhaust dampers 626 and 628 from the fume hoods 612 and 614, respectively. As discussed below in connection with step 770, the control module 630 uses the values W_{G1FL} and W_{G2FL} to adjust the supply flow to accommodate any additional outflow through the dampers 626 and 628. In particular, whenever it becomes necessary to vent fumes through the fume hood via either of the dampers 626 or 628, the supply flow at the supply damper 620 is increased to provide additional air pressure to force air flow through the dampers 626 and/or 628. However, it will be appreciated that instead of increasing the supply flow when it becomes necessary to vent fumes through the fume hood(s), the supply flow may remain constant and the main exhaust damper 624 may be further closed or restricted to force exhaust air flow through the fume hood exhaust dampers 626 and/or 628. Alternatively, a combination of partially closing off the main exhaust damper 624 and further opening the supply damper 620 may be used. However, in the exemplary embodiment described herein, the supply damper 620 is adjusted to compensate for additional (or decreased) flow ~~cause~~ caused by opening (or closing) the fume hood exhaust dampers 626 and/or 628. For this reason, the processing circuit 715 receives W_{G1FL} and W_{G2FL} in step 750, as well as W_T .

- Please replace the paragraph that begins at page 44, line 7, with the following amended paragraph:

The above steps illustrate how the control module 630 may determine the set point for the supply flow damper 620, the exhaust flow damper 624 and the heater coil 616 in order to control the room temperature. It will be appreciated that the control module ~~730~~ 630 may readily be adapted to other methods to control the temperature. The control module 630 further adjusts the supply flow as necessary to compensate for the need for additional air flow to vent fumes out of this exhaust dampers 626 and/or 628.

- Please replace the paragraph that begins at page 44, line 14, with the following amended paragraph:

It is noted, however, that the control module ~~730-630~~ does not directly cause actuators of the heating coil or air flow equipment to act. Instead, the control module ~~730-630~~ merely obtains the set points, W_{FLO} , W_{FL} and W_{HC} , for such equipment. The actuators for the supply damper 620 and heater coil 616 are controlled by the supply flow module 632. The actuator for the main exhaust damper 624 is controlled by the main exhaust module 634.

- Please replace the paragraph that begins at page 44, line 20, with the following amended paragraph:

Referring now specifically to Fig. 8a, the supply flow module 632 has a general construction substantially similar to the module ~~550 1200~~ of ~~Figs. 12a and 12b~~ Fig. 12b. To this end, the supply flow module 632 includes an RF communication circuit 805, a power management circuit 810, an processing circuit 815, an EEPROM 820, and a sensor suite 825. Each of the elements of the control module operates generally as described above in connection with Figs. 12a and 12b.

- Please replace the paragraph that begins at page 45, line 3, with the following amended paragraph:

The control module ~~830 632~~ includes a flow sensing functionality, and is further configured to generate actuator output signals. The actuator output signals may suitably be provided as analog output pins 815a, 815b on the processing circuit 815. The actuator output signals are analog outputs that control the operation of actuators for the heating coil 616 and the damper 620. To this end, the analog output pins 815a and 815b are connected to external actuators 817 and 818.

- Please replace the paragraph that begins at page 46, line 15, with the following amended paragraph:

In step 865, the processing circuit 815 provides an actuator output signal corresponding to Y_{FL} to its output ~~815a~~ 815b, which in turn provides to the actuator ~~817~~ 818 that causes mechanical adjustment of the supply flow damper 620.

Please replace the paragraph that begins at page 46, line 22, with the following amended paragraph:

Fig. 8c shows a flow diagram of the steps of the processing circuit 815 in controlling the actuator ~~818~~ 817 of the heater coil 616. In step 880, the processing circuit 815 receives the heating coil set point W_{HC} through the RF communication circuit 805. The processing circuit 815 thereafter in step 885 sets the actuator control output Y_{HC} to value that is the functional equivalent of W_{HC} and provides Y_{HC} to the output ~~815b~~ 815a. The heating coil actuator control output Y_{HC} then propagates to the actuator ~~818~~ 817. The actuator ~~818~~ 817 thereafter affects the operation of the heating coil 616 in a manner responsive to the control output Y_{HC} in a manner that would be known to those of ordinary skill in the art.

- Please replace the paragraph that begins at page 47, line 11, with the following amended paragraph:

The above operations of the processing circuit 815 cause the supply flow module 632 to control both the heating coil 616 and the supply flow damper 620 to regulate the temperature and fresh air supply into the room 610. As discussed above, the processing circuit 815 uses local RF communications to obtain the necessary set points and other data to carry out the operations. In addition, the processing circuit 815 communicates ~~exhaust~~ supply flow information to the main exhaust module ~~624~~ 634.

- Please replace the paragraph that begins at page 48, line 3, with the following amended paragraph:

Referring now specifically to Fig. 9a, the main exhaust module 634 has a general construction substantially similar to the module ~~420-1200~~ of Figs. 12a and 12b. To this end, the main exhaust module 634 includes an RF communication circuit 905, a power management circuit 910, ~~an a~~ a processing circuit 915, an EEPROM 920, and a sensor suite 925. Each of the elements of the main exhaust module 634 operates generally as described above in connection with Figs. 12a and 12b.

- Please replace the paragraph that begins at page 50, line 4, with the following amended paragraph:

The above operations of the processing circuit 915 operate to control the main exhaust of “spent” air to the room based on the set point W_{FLO} generated by the control module ~~632~~ 630. (See Fig. ~~8b-7b~~). Alternative calculations of the exhaust flow set point W_{FLO} may be made. As discussed further above, in alternative embodiments, the main exhaust flow may be adjusted to redirect air flow through the fume hood exhaust dampers 626 and/or 628. Regardless, one feature of this embodiment of the invention is that balance between the supply flow and the main exhaust flow is adjusted in response to a need to vent air or gas through the fume hood exhausts.

- Please replace the paragraph that begins at page 53, line 7, with the following amended paragraph:

The processing circuit 1015 thereafter periodically receives updates of its inputs and recalculates the ~~actuator~~ gas concentration output signal. In other words, steps 1050 and 1055 are periodically repeated.

- Please replace the paragraph that begins at page 54, line 11, with the following amended paragraph:

To enable the flow sensing functionality, the EEPROM 1120 includes configuration information identifying that the processing circuit 1115 should obtain an air flow measurement information from the MEMS sensor suite 1125. The EEPROM 1120 also includes information

identifying the tolerable limits for concentration of the gas, or in other words, the gas concentration set point W_{G1} for the gas x being measured in the first fume hood 612. In the exemplary embodiment described herein, the EEPROM ~~720~~1120 further includes sufficient program instructions or code to carry out the operations illustrated in Fig. 11b and described below.